Flexible mounts for mounted CCDs

Or what can be done when we mount
an Invar-footed CCD on a molybdenum cold plate

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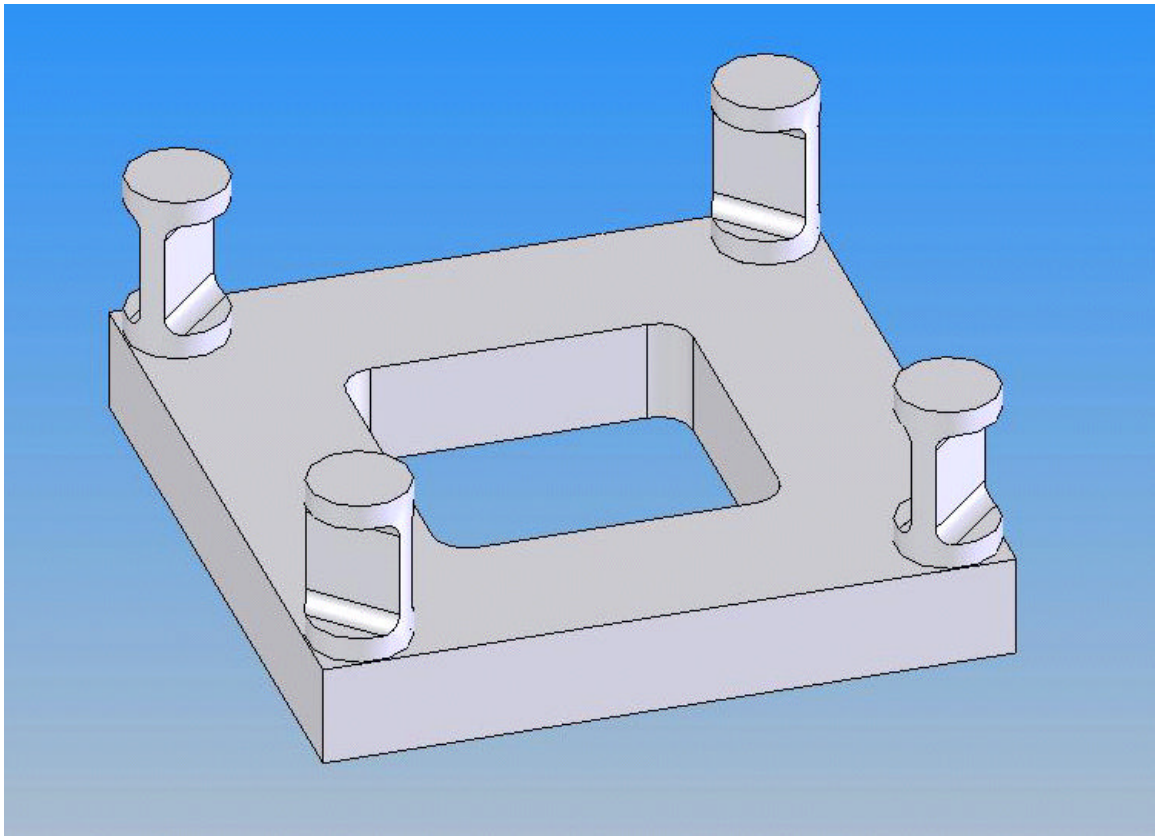


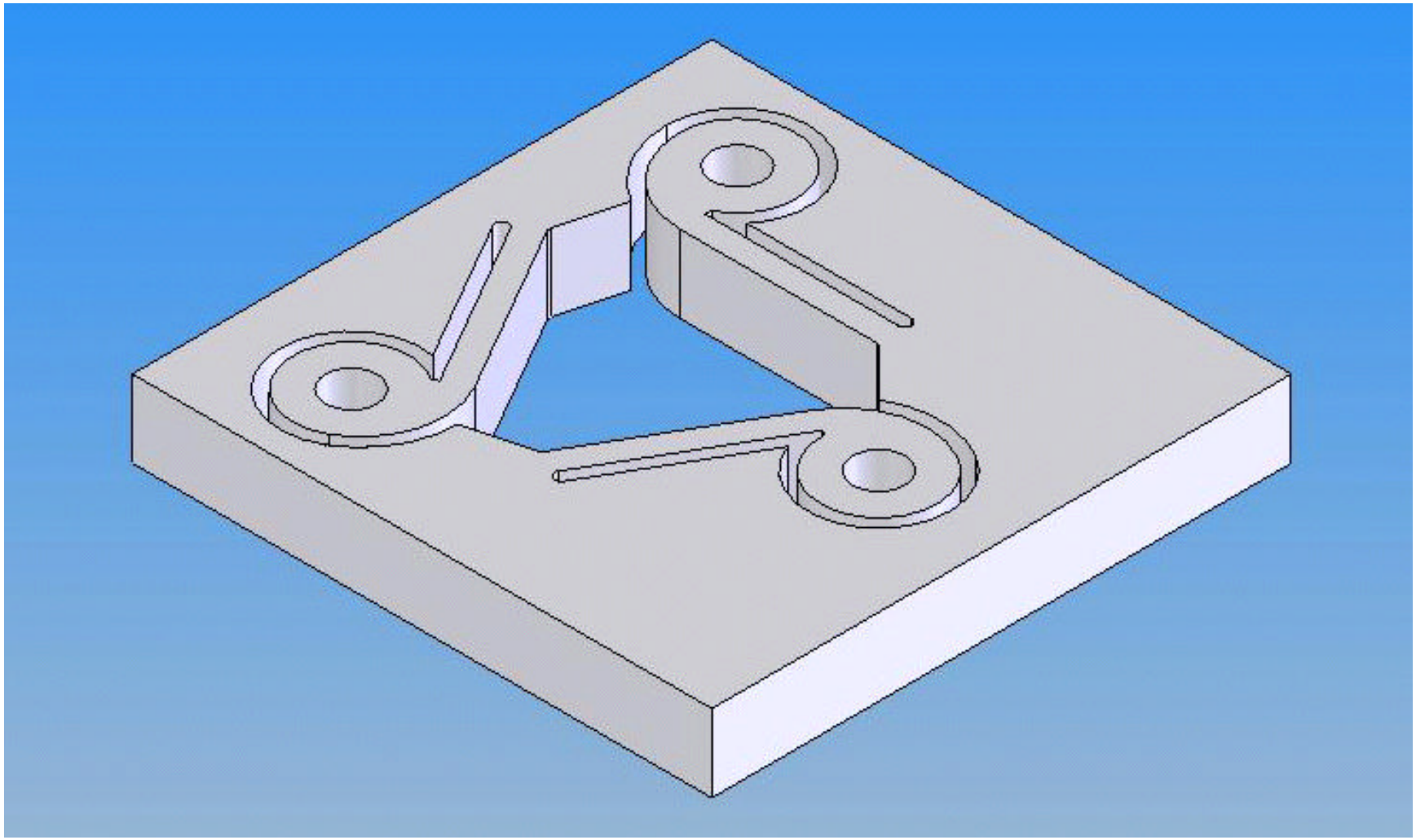
Dave Pankow's flexures – major axes perpendicular to the face of the CCD.

Blade widths tangent to a circle.

For a blade of thickness 1 mm, width of 6 mm, and reduced-width length of 10 mm:

ΔT based on .010 W = .11 K f_n = 6.5 kHz ΔL of CCD = 23 nm

Provides a nice-sized hole through the cold plate for wires.



Mike Sholl's single-arm flexures – major axes parallel to the face of the CCD.

For a blade of thickness 2 mm, width of 6 mm, and reduced-width length of 14 mm:

ΔT based on .013 W = .10 K f_n = 1.8 kHz ΔL of CCD = 40 nm

Provides a good-sized hole through the cold plate for wires.

Mike Sholl's double-arm flexures are similar to his single-arm flexures but have two parallel arms in a four-bar linkage arrangement.

For a blade pair of combined thickness 2 mm, width of 6 mm, and length of 10 mm:

ΔT based on .013 W = .075 K f_n = 1.5 kHz ΔL of CCD = 23 nm

Provides a fair-sized hole through the cold plate for wires.

In all cases, flexures are constrained at the ends and so ensure a parallel offset. This was the basis for the strain and frequency calculations. CCD strain is figured to match the substrate strain and the substrate is figured as 6 mm of Invar or equivalent.

Standards for ΔT, f_n, and ΔL are on the order of one or two tenths K, 0.15 kHz, and 2 µm

These flexures can be massaged to give optimized figures overall. The flexures shown are just a first cut based on engineering guess. For instance, shortening the single-arm flexures to 12 mm and making no other changes would give ΔT based on .013 W = .09 K, f_n = 2.3 kHz, and ΔL of CCD = 63 nm, probably somewhat closer to the mark. Another for instance would be to change the Pankow flexures to 0.5 thick. Then the new outputs would be ΔT = 0.23K, f_n = 0.38 kHz, and ΔL of CCD = 3 nm.

In conclusion, it's all good. We'll have to decide on other bases than temperature drop, natural frequency, and strain in the CCD foot.
Perhaps we might think of machining cost and assembly complication.